**Q1:**

Data: 1011

G: 1001

Step 1: Add r = 3 bits 0 to the data

* Data = 1011000

Step 2: Divide the string of data bits obtained in Step 1 by the generating polynomial

1011 1001

1001 1

0010

* R = 010

Step 3:The bit sequence to be transmitted is : 1011010

**Q2:**

Percentage of the transmitted bits in th physical layer correspond to message information:

If L = 100 bytes:

% = 100/(100 +20 +20 +18)\*100 = 63,3%

If L = 500 bytes:

% = 500/(500 +20 +20 +18)\*100 = 94,7%

If L = 100 bytes:

% = 1000/(1000 +20 +20 +18)\*100 = 94,5%

**Q3:**

Data: 10011101

G: 1001

Step 1: Add r = 3 bits 0 to the data

* Data = 10011101000

Step 2: Divide the string of data bits obtained in Step 1 by the generating polynomial

10011101 1001

1001 10001

00001101

1001

0100

* R = 100

Step 3:The bit sequence to be transmitted is : 10011101100

**Q4:**

**a,** IP 135.46.63.10 sub net mask is /22 => Network address has 22 bit

From left to right:

|  |  |  |  |
| --- | --- | --- | --- |
| 135 | 46 | 63 = (00111111)2 | 10 |
| 8 bit  Need all 8 bits | 8 bit  Need all 8 bits | 8 bit   * Need more 6 bit(total 22 bits)(other bits write as 0) * 00111100 = (60)10 | 8 bit  No need more  Write as 0 |

* 135.46.60.0/22
* Router will forward the packet to the interface 1

**b,** IP 135.46.57.14 sub net mask is /22 => Network address has 22 bit

From left to right:

|  |  |  |  |
| --- | --- | --- | --- |
| 135 | 46 | 57= (00111001)2 | 10 |
| 8 bit  Need all 8 bits | 8 bit  Need all 8 bits | 8 bit   * Need more 6 bit(total 22 bits)(other bits write as 0) * 00111000 = (56)10 | 8 bit  No need more  Write as 0 |

* 135.46.56.0/22
* Router will forward the packet to the interface 0

**Q5:**

Uncompressed text file size: 1 megabyte = 1024\*1024\*8 (bits)

Modem speed = 32 kilobit/second = 32\*103 (bit/second)

* Time to download file = 1024\*1024\*8/32\*103 = 262 (s)

Modem speed = 1 megabit/second = 106 (bit/second)

* Time to download file = 1024\*1024\*8/106 = 8,39 (s)

Maximum compression ratio 1:6

* The compressed file 6 times smaller than uncompressed file size
* In part(a): the time = 262/6 = 43 (s)
* In part(b): the time = 8,39/6 = 1.398 (s)